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Design Division

BAUSCH & LOMB

Grating Monochromators

WITH **CERTIFIED-PRECISION** GRATINGS

BAUSCH & LOMB

Grating Monochromators

WITH CERTIFIED–PRECISION GRATINGS*

- 250mm focal length
- 500mm focal length

Made in the B&L Grating Ruling Laboratory

These instruments are dual purpose equipment, used by themselves as optical instruments for delivery of monochromatic light, or as adjuncts to other optical apparatus. In the first instance they are used for direct irradiation work, as in the biological field. They also serve as sources of light of very high spectral purity for use in ultraviolet microscopy, photo-chemistry, physical chemistry, or, they serve, with photo-electric receivers, in the field of spectro-photometry.

OPTICAL SYSTEM

The B&L Monochromator provides for light from an illuminated slit being directed by a small plane mirror to a concave collimating-condensing mirror, dispersed by a plane Certified-Precision Grating with efficiency of approximately 65% at 2650A, and condensed by the same mirror to the exit slit. The entrance slit lies in the focal plane of the concave mirror and the beam is, therefore, collimated for all wavelengths when it leaves this mirror. Since the mirror acts in a dual capacity it is larger than the parallel beam so that full aperture is obtained in both the entering and dispersed beams.

Quartz condensers image the source at the slit. In addition to this condensing system a quartz lens at the exist slit images the grating at a point about 60mm in front of the housing. The image is square and about 12.5mm on a side.

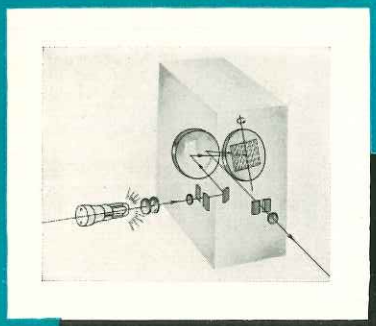
GRATING

The Certified-Precision Grating (a product of the Bausch & Lomb Grating Ruling Laboratory) has a ruled area 50mm square in the 250mm instrument and 100mm square in the 500mm instrument. The former has 600 grooves per mm, while the latter comes with either 600 or 1200 grooves per mm, as ordered.

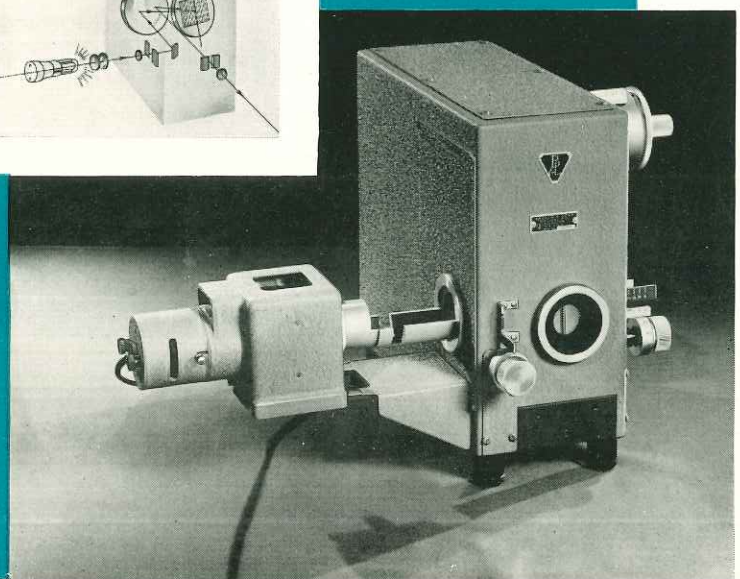
These two Monochromators are, therefore, of the same numerical aperture but the 500mm model with the 600 grooves/mm grating has twice the linear dispersion of the 250mm. Linear dispersions are 3.3 millimicrons per mm and 6.6 millimicrons per mm, respectively. With the 1200 grooves/mm grating in the 500mm model the linear dispersion is increased to 1.6 $m\mu$/mm. The 600 grooves/mm grating in either instrument covers the region from 200 $m\mu$ to 1400 $m\mu$ in the first order and the 1200 grooves/mm grating, 200 to 700. For these monochromator gratings the blaze is for ultraviolet of the first order, providing a maximum intensity in that order.

THE GRATING MOUNT

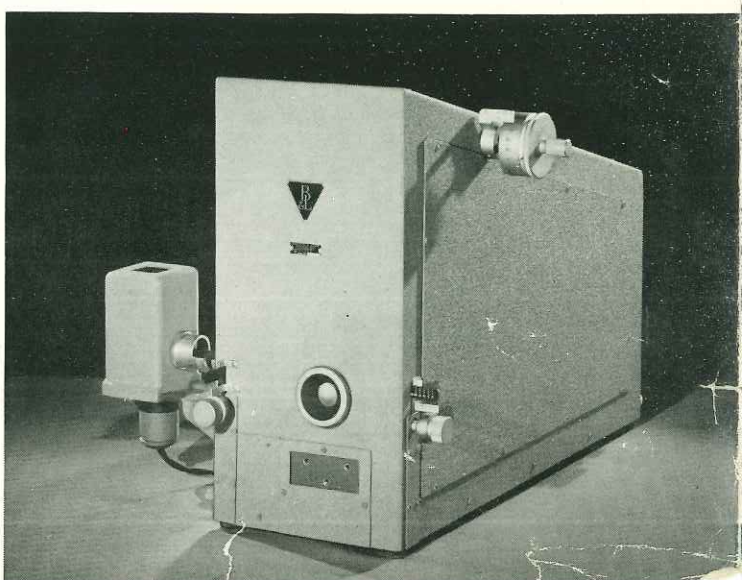
Rotated to place different wavelengths on the exit slit, the grating mount is strictly linear with wavelength in its rotation. Adjustment is made by revolving a drum which actuates a screw device. The drum, reading directly to millimicrons, moves in and out horizontally beneath a fixed scale graduated in 100 $m\mu$ steps.



(Inset) Optical elements of the Monochromators.



The 250mm model with high intensity Mercury Arc Light Source. There is a choice of three interchangeable sources and list prices include an illuminator. (If it is desired to have more than one type of source available, the others can be ordered extra.)



The 500mm model with visible light source.

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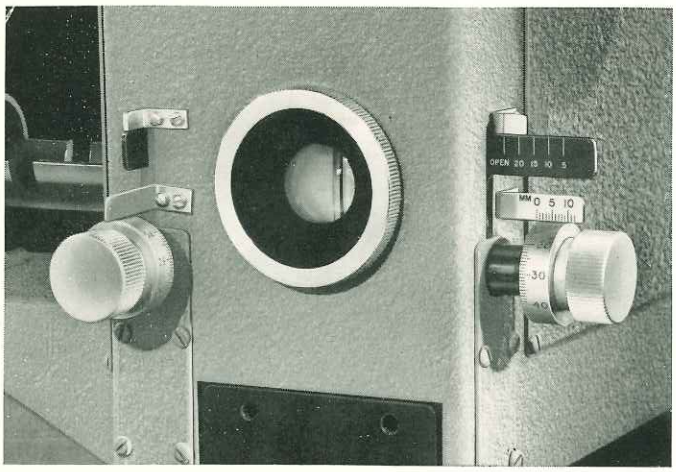
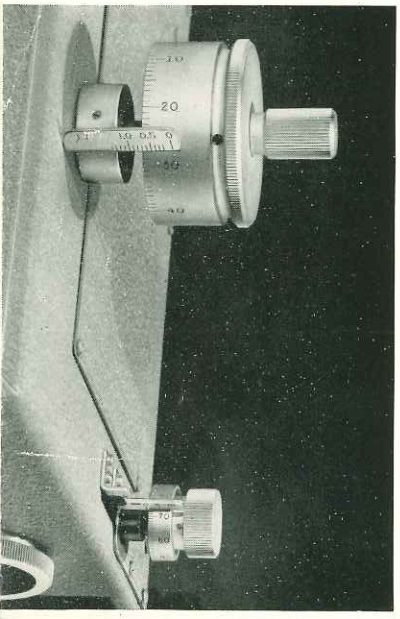
THE SLITS

The symetrically opening entrance and exit slits are identical. Jaws are operated in opposition by a double screw mechanism actuated by a traveling drum divided in hundredths, each complete turn being equal to 1mm as indicated on the turn counting scale above the drum. Slits open to a full width of 12mm and have a maximum height of 20mm. The latter is controlled by a V-slide calibrated in 5mm steps.



Knob and slide at both entrance (left) and exit (right) slits regulate width and length of slits. Each turn of the drum is equivalent to 1mm as shown on the turn counting scale.



Wavelength drum is divided in millimicrons and the hundredths are read on the turn indicator.

ILLUMINATION

Three sources are available: (1) A high intensity Mercury Arc of the U-Shaped Hanovia type, for U-V Microscopy and other work requiring line spectra, (2) A ribbon filament for work in the visible region of the spectrum and (3) Hydrogen Arc Nestor type light source for work requiring continuous spectrum illumination in the ultraviolet.

The quartz lenses which image the source upon the slit are of sufficient aperture to fill the optical system which operates, with respect to light-gathering power, at *f*/4.4.

At the first pair of lenses there is a square diaphragm, the image of which as formed by the slit collective lens on the grating, is just sufficient to fill the ruled area. Stray light reflected from mounts, is, therefore, reduced to a minimum. At no point in the system does the beam exceed the size of the optical elements.

For specific applications of these Monochromators to particular problems Bausch & Lomb will be glad to assist in working out proper equipment combinations.

Bausch & Lomb 250mm and 500mm Focal Length Grating Monochromators

SPECIFICATIONS:

Linear Wavelength Scale	Factory set—no calibration required
Certified-Precision Grating	High efficiency
Compact 250mm	12½" x 5⅜" x 11¾"
Compact 500mm	24¾" x 9¼" x 19⅜"
High Spectral Purity	Less than .1% of stray light at 2650A
Wide Range	2000-14,000A in first order
Achromatic	Reflecting optics—no focusing required for different wavelengths
High Linear Dispersion	250mm-66A/mm—500mm 33A/mm or 16A/mm
Wide Range of Slits	12mm x 20mm adjustable
Low Cost	With choice of Light Source

FEATURES:

	250mm	500mm	500mm (optional choice)
Focal Length			
Grating Area	50mm x 50mm 600 grooves/mm	100mm x 100mm 600 grooves/mm	100mm x 100mm 1200 grooves/mm
Dispersion	66A per mm (first order)	33A per mm (first order)	16.5A per mm (first order)
Grating Efficiency	65% at 2650A	65% at 2650A	65% at 2650A
Range	2,000-14,000A (first order)	2,000-14,000A (first order)	2,000-7,000A (first order)
Equivalent Aperture Ratio	*f*/4.4	*f*/4.4	*f*/4.4

Ordering Information and Prices

Catalog No.	Description	Price
33-86-40-01	250mm Grating Monochromator with 600 grooves/mm Certified-Precision Grating and No. 33-86-42 High Intensity Mercury Arc Light Source	$1,150.00
33-86-40-02	250mm Grating Monochromator with 600 grooves/mm Certified-Precision Grating and No. 33-86-44 Ribbon Filament Visible Light Source	1,075.00
33-86-40-03	250mm Grating Monochromator with 600 grooves/mm Certified-Precision Grating and No. 33-86-46 High Pressure Hydrogen Arc Illuminator	1,500.00
33-86-45-48	500mm Grating Monochromator with 600 grooves/mm Certified-Precision Grating and No. 33-86-42 High Intensity Mercury Arc Light Source	1,800.00
33-86-45-58	500mm Grating Monochromator with 600 grooves/mm Certified-Precision Grating and No. 33-86-44 Ribbon Filament Visible Light Source	1,725.00
33-86-45-68	500mm Grating Monochromator with 600 grooves/mm Certified-Precision Grating and No. 33-86-46 High Pressure Hydrogen Arc Illuminator	2,150.00
33-86-45-49	500mm Grating Monochromator with 1,200 grooves/mm Certified-Precision Grating and No. 33-86-42 High Intensity Mercury Arc Light Source	2,200.00
33-86-45-59	500mm Grating Monochromator with 1,200 grooves/mm Certified-Precision Grating and No. 33-86-44 Ribon Filament Visible Light Source	2,125.00
33-86-45-69	500mm Grating Monochromator with 1,200 grooves/mm Certified-Precision Grating and No. 33-86-46 High Pressure Hydrogen Arc Illuminator	2,550.00

Light Sources for Use With Any of the Three Monochromators, when ordered separately

33-86-42	High Intensity Mercury Arc Light Source	150.00
33-86-44	Ribbon Filament Visible Light Source	75.00
33-86-46	High Pressure Hydrogen Arc Illuminator	500.00
33-86-43	Condensing Lens for use with 33-86-40-01 Grating Monochromator for U-V Microscope Work	110.00

ACCESSORIES for ultra-violet microscopy

The 250mm Monochromator with the high intensity mercury arc light source furnishes a satisfactory illuminator for microscopy and photomicrography in the ultraviolet, where a continuous spectrum is desirable. It is only necessary to substitute the UV condenser lens for the collective lens at the exit slit of the monochromator, and put the reflecting UV optics on the microscope.

The monochromator condenser is constructed of quartz and fluorite lens elements and is sufficiently corrected chromatically to eliminate the necessity of refocusing the lens for different wavelengths.

The microscope equipment includes suitable ultraviolet transmitting optics as follows:

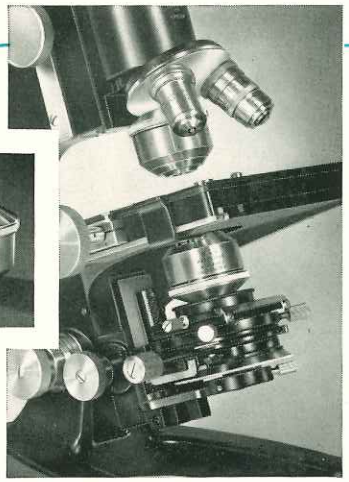
OBJECTIVE

Equivalent focal length, 2.8mm
Numerical Aperture, 0.72 maximum
Occluded Numerical Aperture, 0.21
Initial magnification at tube length of 160mm, 53×

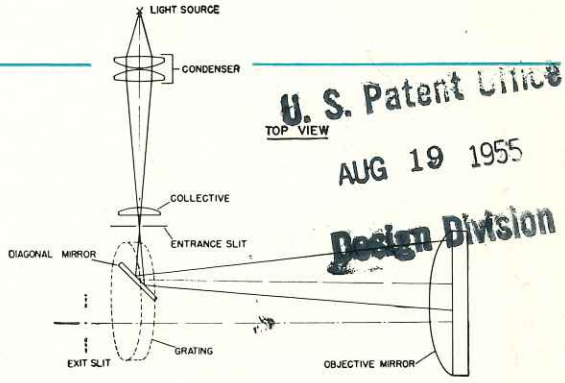
The objective is adjusted for use with a 1mm thick quartz object slide covered with a fused-quartz cover slip 0.18mm thick. Strict adherence to cover slip thickness is desirable for maximum image quality.

The objective incorporates two spherical reflecting surfaces combined with elements of quartz and fluorite which act as supports for one of the reflectors, and act as refracting elements to complete the correction of the objective. While complete achromatism is not obtained with the objective (partially due to dispersion in the cover slip over the specimen), nevertheless, a focal setting made in visible light will usually suffice for photography throughout the ultraviolet region. Any shift from precise focus in the visible to that at some region in the ultraviolet is slight and can be determined readily.

Ultra-violet microscope accessories.



Ultra-violet reflecting microscope accessories on B&L Model EDR Research Microscope.



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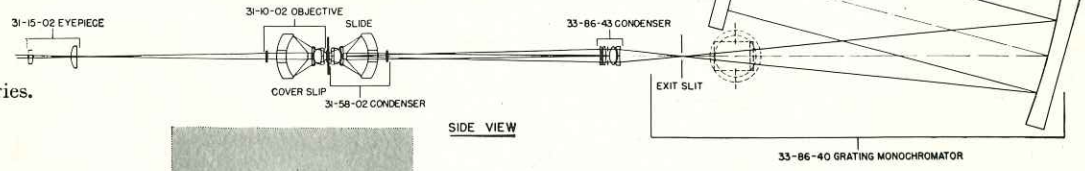
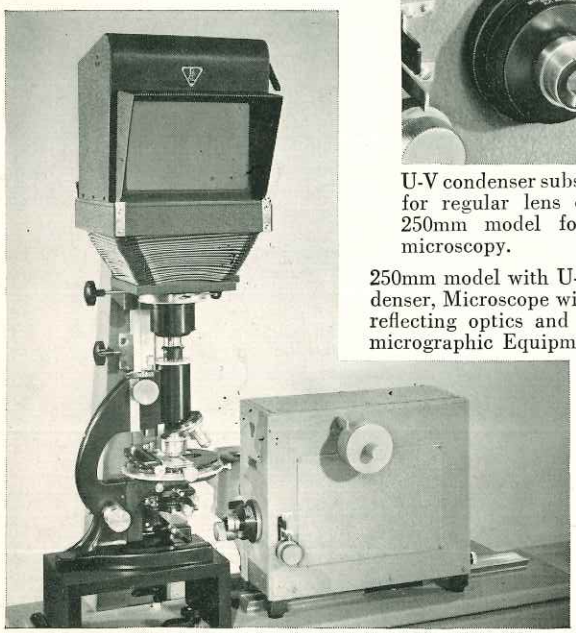


Path of light through Monochromator and microscope equipped with ultra-violet accessories.

U-V condenser substitutes for regular lens on the 250mm model for U-V microscopy.



250mm model with U-V condenser, Microscope with U-V reflecting optics and Photomicrographic Equipment.

SUBSTAGE CONDENSER

The use of a second reflecting objective has been found most satisfactory. Consequently, the substage condenser is identical in form with the objective.

EYEPIECE

For purposes of projecting an image in the ultraviolet for photography or transmission measurements, a 10× Huygenian eyepiece is used. This resembles a standard microscope eyepiece but incorporates lenses of crystal quartz.

Catalog No.	Item	Price
31-15-02	Quartz eyepiece, 10×	$ 75.00
31-10-02	Reflecting objective, 53×, 0.72 N.A.	490.00
31-58-02	Reflecting condenser, 0.72 N.A.	490.00

Prices are subject to change without notice. Orders are subject to acceptance at Rochester, N. Y., U. S. A., at prices prevailing at time of shipment. Orders for standard items may be cancelled if not wanted because of price advance. Excise taxes or other governmental charges will be added wherever applicable. Shipments to points outside Continental United States of America and to its territories, dependencies and possessions, except Hawaii and Alaska, are not subject to excise taxes. Delivery dates are estimated and cannot be guaranteed.

BAUSCH & LOMB OPTICAL CO.
Rochester 2, New York

D-259, 8.5, Jan. '55 C-H
Printed in U.S.A.